QUATERNARY PHREATOMAGMATIC VOLCANOES OF SOUTHERN TENERIFE, SPAIN: MONTANA PELADA TUFF RING AND CALDERA DEL REY MAAR

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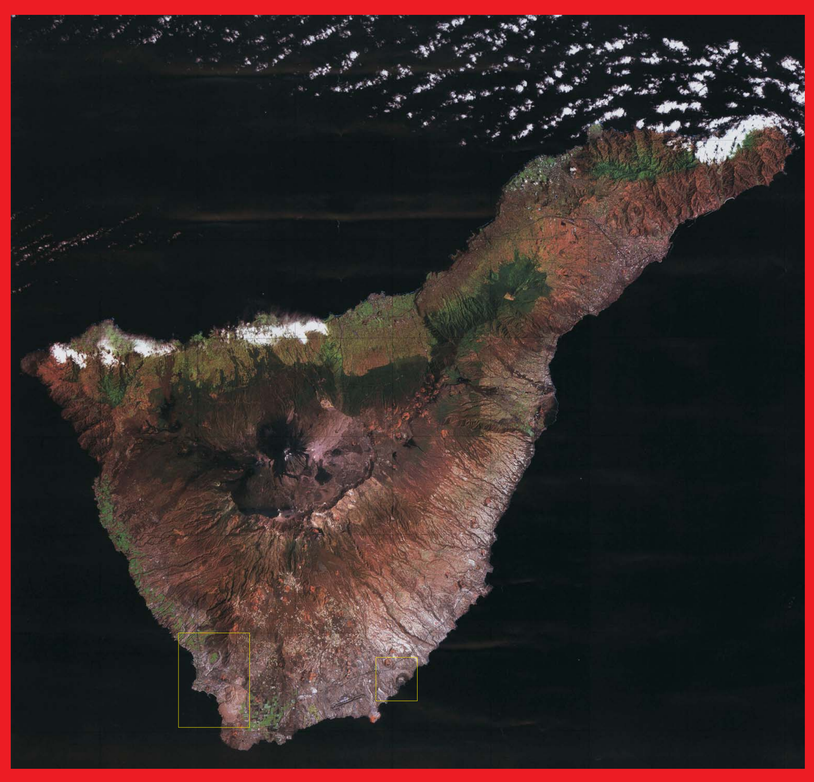
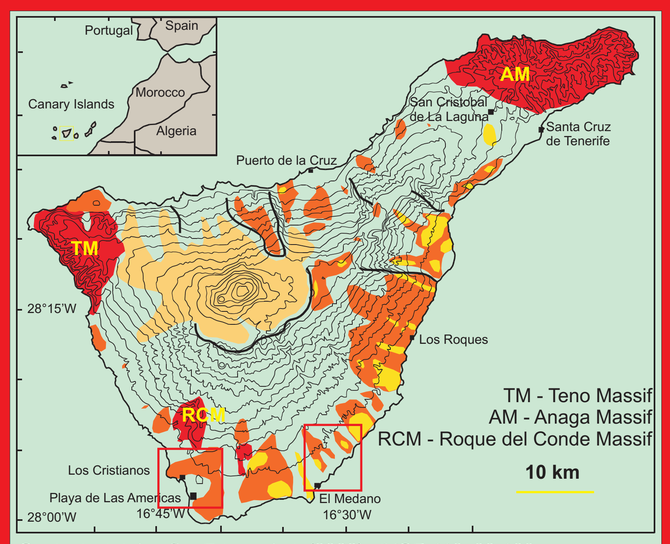
Abstract

Quaternary monogenetic volcanoes in southern Tenerife are part of a rift zone extending from the Pico del Teide to the south. In this rift zone scoria cones are often clustered into smaller volcanic massifs form an extensive volcanic field. In the southern margin of this rift zone, near the Atlantic shoreline 2 phreatomagmatic volcanoes are known. Montaña Pelada is a tuff ring 1.2 km across and stands about 100 m above the sea level. The pyroclastic succession of the tuff ring is very monotonous and consists of accidental lithic rich bedded lapilli tuff. The pyroclastic rocks in the base are richer in accidental lithic fragments derived from pre-tuff ring lava than in the upper section. A gradual transition to a more bedded texture of the pyroclastic units is prominent. In the upper section of the unit dm thick beds rich in cauliflower bombs and scoriaceous lapilli indicate that the vent of the volcano has been cleared by this time of the eruption. The crater of the Montaña Pelada is filled with massive lapilli tuff forming m-thick units that are inferred to be intra-crater lahars. Above the reworked pyroclastic units immature soil horizon indicates terrestrial conditions in the tuff ring crater. Within the tuff ring two pyroclastic flow units are preserved indicating their high momentum to allow the ignimbrite to overrun the tuff ring and destroy a small scoria cone that occupied the tuff ring crater.

Just 15 km to the west a large maar, Caldera del Rey forms a ~ 150 m deep, rift parallel elongated double depression. The pyroclastic succession of the maar is about 70 m thick in the crater rim. In near-vent position thickly bedded, accidental lithic rich lapilli tuff units are inferred to have been deposited from high concentration laminar flows e.g. pyroclastic flows. These units are mantled by thin base surges. In these units, impact sags are rare. In the upper section of the tuff ring deposits an increased number of impact sags, dune-bedded base surge deposits and slumping structures indicating gradual change of the eruption mechanism of the maar. About 800 metres away from the crater rim, behind





Geological data after Edgar et al. (2002), JVGR 118, 99-130

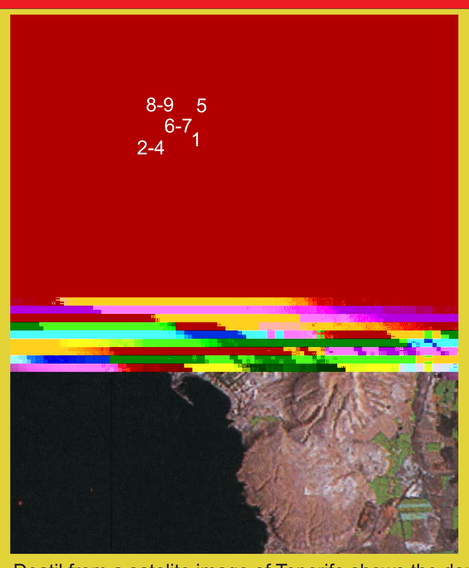
Teide - Pico Viejo Complex

Poris Member

Diego Hernandez Formation

Old Basaltic Series (Teno Massif, Anaga Massif, Roque del Conde Massif)

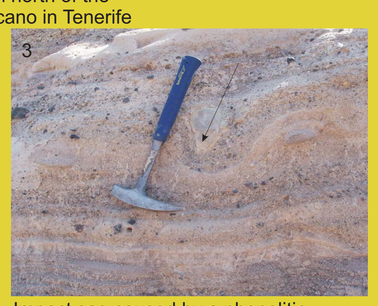
Caldera del Rey Maar



Deatil from a satelite image of Tenerife shows the double maar crater of Caldera del Rey. Note the scoria cone and its lava flow in the southwest and the depression north of the cone, another good candidate for a maar volcano in Tenerife

Maar crater of the Caldera del Rey from the west. In the background the Roque del Condes Massif (RCD) blcks are visible.

Undulating bedded base surge succession about 400 metres from the crater rim of Caldera del Rey.



Impact sag caused by a phonolitic cauliflower bomb (arrow) in a coarse grained lapilli tuff unit deposited from high concentration base surge clouds

Soft sediment slumping and deformation textures in near vent phreatomagmatic pyroclastic units about 400 metres from the crater rim. Vesiculated tuffs are common in this distance from the crater rim.

Unconformity surface (dashed line) of the crater rim. Note the persistent steep bedding and continuous bedded (lines) but massive character of the pyroclastic units

Massive lapilli tuff succession in near vent (200 m from rim) position deposted from high concentration pyroclastic surges and/or pyroclastic flows.

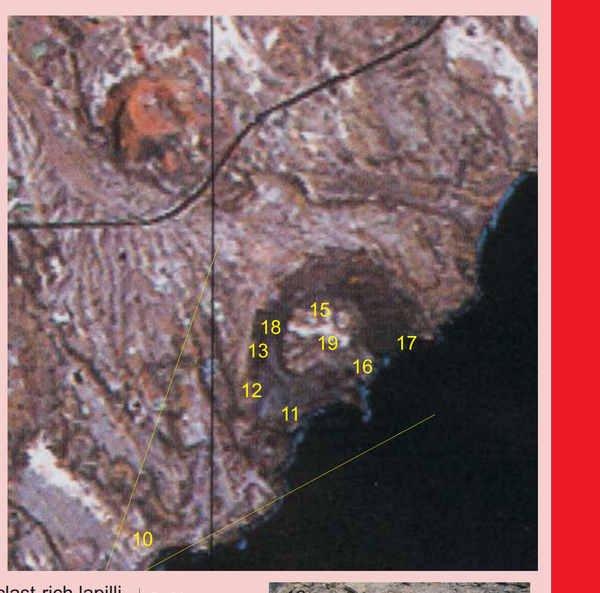
Accretionary lapilli-rich bedded tuff in a eruption cloud shadow behid an older basaltic lava flow ridge, about 700 m from the maar rim.

Antidune and dune bedded, cross bedded, accretionary lapilli-rich base surge succession about 1000 m from the crater rim

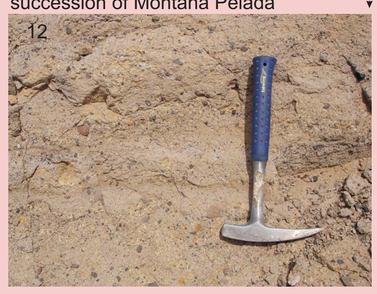
Rim-type accertionary lapilli (arrows) beds about 700 metres from the crater rim in current shadows

Montana Pelada tuff ring

Monotoneous coarse-fine lapilli tuff succession of Montana Pelada.

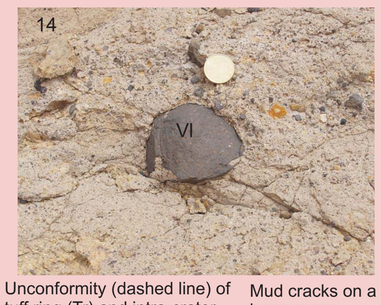


Volcanic accidental lithic clast-rich lapilli tuff is the main facies of the pyroclastic succession of Montana Pelada



Softly deformed impact crater (arrow) in the Montana Pelada succession indicating water saturated sediments upon deposition.

Rounded volcanic accidental lithic (Vl) derived from the pre-tuff ring lava flows and associated fluvial systems.

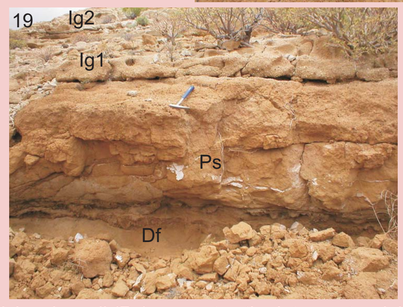


Unconformity (dashed line) of tuff ring (Tr) and intra-crater debris flow (Df) units in the crater rim of the Montana Pelada souteastern section.

Mud cracks on a base surge bedding plane in the top section of the tuff ring.

Ignimbrite units of the Poris Member in the tuff ring crater indicating the destructive power of the Tenerife ignimbriets (Ig) so far from their source.

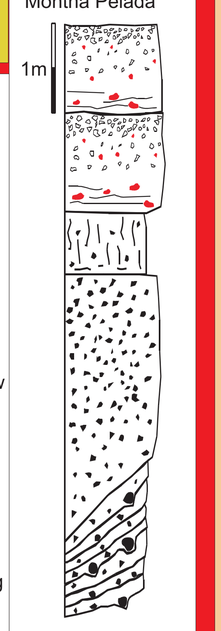
Intra-crater volcaniclastic debris and mud flow units suggesting post-volcanic remobilisation of tephra into the crater.

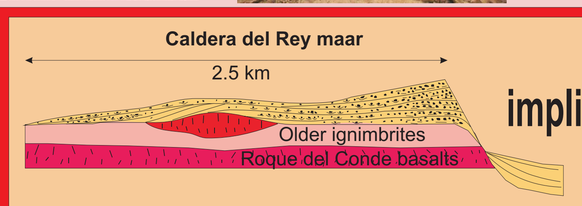


Thick paleosoil (Ps) separates the intra-crater debris flow (Df) deposits and the crater filling ignimbrites (Ig1,

Distal pyroclastic facies

Approximately 1000 metres away from the maar crater centre typical distal pyroclastic phreatomagmatic deposits cover the surroundings of the Caldera del Rey maar. The pyroclastic units are rich in high energy bedforms indicating that the pyroclastic surges derived from the maar were dilute but still had significant momentum. Such depoists are especially common in the outcrops in the township of Playa de Las Americas and still traceable in the Atlantic shoreline suggesting a potencial volcanic hazard in case of a recurrence of such volcanoes in the vicinity of the town.





Conclusion and implication for volcanic hazards

- base surge beds of Caldera del Rey are still over a meter thickness 1500 m from the crater rim.
- upto 500 metres from the crater rim of Caldera del Rey the pyroclastic succession is over 20 metres thick and consists of massive, stratified lapilli tuff beds.
- ballistic bombs upto 10 cm in diameter with deep impact craters are abundant in the Caldera del Rey pyroclstic succession about 1000 metres from the crater rim.
- the crater of Montana Pelada tuff ring is filled with massive volcaniclastic debris flow deposits. This deposits pose potential hazard after deposition in case of crater wall collapse and sudden emptying of the slurry to the surroundings.
- phreatomagmatic volcanoes and/or phreatomagmatic stages of the evolution of scoria cones are expected in the end of the rift zones near sealevel, where the main touristic developments are. Therefore further study of such volcanoes because of their destructive effect on the surroundings should be done.

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